

## CHEM 316. INSTRUMENTAL METHODS OF CHEMICAL ANALYSIS

**Class time:** Mon & Wed 11-11:50 AM, Aug 22-Dec 15, 2022.

**Classroom:** 1810 Gilman

**Prerequisites:** CHEM 211, CHEM 211L, Math 166, and *concurrent enrollment in 316L*, Phys 222 recommended.

**Canvas:** This course uses Canvas for all useful resources including this syllabus, lecture notes, announcements, manage grades, homework submission.

<https://canvas.iastate.edu/courses/71654>

**Lecture Quiz:** Through Top Hat (tophat.com). Course ID: 628132.

**Office Hour:** Fri 11-11:50am or make an appointment.

In-person or WebEx personal room (<https://iastate.webex.com/meet/yjlee>).

**INSTRUCTOR:** Young-Jin Lee, PhD, Professor, Department of Chemistry

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### Course Objectives:

- *Understand operational principles of major instruments* used in analytical measurements.
- *Understand key figures of merits in each instrumentation* such as precision, resolution, sensitivity, and selectivity, *and how they are compared* between different instruments.
- *Be able to make informed decisions* which analytical methods are best suited for the study of a particular measurement.
- *Gain hands on experience* using some of the analytical methods discussed in this course in the accompanying laboratory course (CHEM 316L).

**TEXT:** Principles of Instrument Analysis, 7th ed., 2017, Skoog, Holler, and Crouch  
: If you already have 6th edition, there might be only minimal difference.

### GRADING:

**Three mid-term exams (15% each)**

**Final Exam (30%)**

**Lecture Quiz (Top Hat) (15%)**

**Homework (10%)**

**NOTE:** Final grades are based solely on graded work and are NOT negotiable. The final grade distribution will be curved and consistent with prior years.

### Exams:

**Mid-term Exam Date: Sep 26, Nov 2, Dec 7**

**Final Exam: Dec 14, 9:45-11:45am**

Final exam is 2hr cumulative exam *with focus on overall course objective*.

Students who have *three or more finals on the same calendar day* may request to reschedule a final. The instructor of the course having the smallest number of students is responsible for arranging an alternate examination time for the student unless make-up exam times are available in one of the other courses. To reschedule, the student must notify the instructor prior to the last day of class before the beginning of dead week so the instructor has time to make appropriate arrangements.

The use of cell phones, media players, electronic translators, wireless communication devices, etc. is prohibited during exams. A Periodic Table, appropriate equations, and physical constants will be provided on the back sheet of each exam, if needed.

**Scheduling conflict: There are *no make-up exams*.** In the case of a scheduling conflict, students must contact the instructor to arrange accommodations *at least one week prior* to the exam. In the case of a *documented emergency* on the day of an exam, contact the instructor as soon as possible. An arrangement could be made in such cases *if approved*. A written document for such a valid reason (course schedule, travel for university events, medical emergency, etc.) is needed. A student who misses two exams will be asked to drop the course.

### **Lecture quiz:**

It will be administered through Top Hat during the class. There will be quiz almost every day. Participants in the course evaluation at the end of the semester will receive extra five points in lieu of quiz point. Out of a total of ~110 lecture quiz points, only up to 100 point will be counted toward the final grading. *You may be allowed to do the make-up quiz if you are absent for legitimate reasons.*

### **Homework:**

There will be **homework for almost every chapter**. The **problems and due dates** are one week after the class as indicated in the *Tentative Class Schedule* of this syllabus. Each HW set is 5 point. Out of total possible score of 70pt (14set x 5pt), only 66.7 pt will be included for the grading purpose.

**Homework should be submitted via Canvas, either typing in or uploading a file (e.g., handwritten paperwork) by 11:59pm on due date.** There is late penalty of 10% each day for the next three days. Late homework is not accepted after three days unless approved by the instructor in advance. The TA will grade each student's homework for completeness and only selected problems for correctness.

### **Class Preparation and Conduct:**

**Reading the textbook is necessary to pass this course.** Relevant chapters are indicated on the class schedule. *Exam will be only from the materials covered in class or in homework.*

To help promote a good learning environment for all, please be respectful in your behavior towards your fellow students and your instructor. Please refrain from any disruptive activities in the class, which might affect other students. **Your classmates are allowed and encouraged to ask you to discontinue distracting behavior. Students disturbing class will be asked to leave the room.** Turn off all electronic notifications during lecture.

It is to your benefit to participate in classroom discussions and ask questions!

## **Academic Dishonesty**

The class will follow Iowa State University's policy on academic misconduct ([5.1 in the Student Code of Conduct](#)). Students are responsible for adhering to university policy and the expectations in the course syllabus and on coursework and exams, and for following directions given by faculty, instructors, and Testing Center regulations related to coursework, assessments, and exams. Anyone suspected of academic misconduct will be reported to the [Office of Student Conduct in the Dean of Students Office](#). Information about academic integrity and the value of completing academic work honestly can be found in the [Iowa State University Academic Integrity Tutorial](#).

## ***Accessibility Statement***

Iowa State University is committed to advancing equity, access, and inclusion for students with disabilities. Promoting these values entails providing reasonable accommodations where barriers exist to students' full participation in higher education. Students in need of accommodations or who experience accessibility-related barriers to learning should work with Student Accessibility Services (SAS) to identify resources and support available to them. Staff at SAS collaborate with students and campus partners to coordinate accommodations and to further the academic excellence of students with disabilities. Information about SAS is available online at [www.sas.dso.iastate.edu](http://www.sas.dso.iastate.edu), by email at [accessibility@iastate.edu](mailto:accessibility@iastate.edu), or by phone at 515-294-7220.

## ***Discrimination and Harassment***

Iowa State University does not discriminate on the basis of race, color, age, ethnicity, religion, national origin, pregnancy, sexual orientation, gender identity, genetic information, sex, marital status, disability, or status as a U.S. Veteran. Inquiries regarding non-discrimination policies may be directed to Office of Equal Opportunity, 3410 Beardshear Hall, 515 Morrill Road, Ames, Iowa 50011, Tel. 515-294-7612, Hotline 515-294-1222, email [eooffice@iastate.edu](mailto:eooffice@iastate.edu)

## ***Religious Accommodation***

Iowa State University welcomes diversity of religious beliefs and practices, recognizing the contributions differing experiences and viewpoints can bring to the community. There may be times when an academic requirement conflicts with religious observances and practices. If that happens, students may request the reasonable accommodation for religious practices. In all cases, you must put your request in writing. The instructor will review the situation in an effort to provide a reasonable accommodation when possible to do so without fundamentally altering a course. For students, you should first discuss the conflict and your requested accommodation with your professor at the earliest possible time. You or your instructor may also seek assistance from the [Dean of Students Office](#) at 515-294-1020 or the [Office of Equal Opportunity](#) at 515-294-7612.

## ***Public Health***

If you are not feeling well, you should stay home and focus on your health. Should you miss class due to illness, it is your responsibility to work with your instructor to arrange for accommodations and to make up coursework, as consistent with the instructor's attendance policy.

You may choose to wear a face mask and/or receive the COVID-19 vaccine and boosters, as well as other vaccines such as influenza, but those options are not required. Thielen Student Health Center will continue to provide COVID-19 vaccinations free-of-charge to students. The university will continue to offer free masks and COVID-19 test kits during the fall 2022 semester. Other wellbeing resources for students are available at: <https://www.cyclonehealth.iastate.edu/wellbeing-resources/> Public health information for the campus community continues to be available on Iowa State's [public health website](#). All public health questions should be directed to [publichealthteam@iastate.edu](mailto:publichealthteam@iastate.edu).

## ***Contact Information for Academic Issues***

If you are experiencing, or have experienced, a problem with any of the above statements, email [academicissues@iastate.edu](mailto:academicissues@iastate.edu)

## TENTATIVE CLASS SCHEDULE

	Date	Reading	Homework	HW due
<b>M</b>	<b>Aug 22</b>	Ch 1. Introduction, Appendix 1	Ch 1: 9, Example 1-2 (a & c only); Appendix a1: 3, 6	<b>Aug 29</b>
<b>W</b>	<b>Aug 24</b>	Ch 5. Signal & Noise	Ch 5: 1, 2 (a & b only), 3, 5, 8, 9	
<b>M</b>	<b>Aug 29</b>			<b>Sep 5</b>
<b>W</b>	<b>Aug 31</b>	Ch 6. Intro to Spectroscopy	Ch 6: 2, 5, 7	<b>Sep 7</b>
<b>M</b>	<b>Sep 5</b>	<b>Labor Day</b>		
<b>W</b>	<b>Sep 7</b>	Ch 7A-D. Optical Component	Ch 7: 2, 6, 12	<b>Sep 14</b>
<b>M</b>	<b>Sep 12</b>	Ch 8A-B. Intro to Atomic Spectroscopy	Ch 8: 1, 8, 9	<b>Sep 19</b>
<b>W</b>	<b>Sep 14</b>	Ch 9A-D. Atomic Absorption		
<b>M</b>	<b>Sep 19</b>	Ch 10A. Atomic Emission Spectroscopy	Ch 9: 3, 12, Ch 10: 2, 9	<b>Sep 26</b>
<b>W</b>	<b>Sep 21</b>	Exam review		
<b>M</b>	<b>Sep 26</b>	<b>Exam 1</b>		
<b>W</b>	<b>Sep 28</b>	Ch 13. Intro to UV/Vis (except 13C, 13D-3)		
<b>M</b>	<b>Oct 3</b>	Ch 14A-D. Application of UV/Vis	Ch 13: 1, 2, 3, Ch 14: 8, 10(a-d only)	<b>Oct 10</b>
<b>W</b>	<b>Oct 5</b>	Ch 15A-C. Luminescence	Ch 15: 2 (a-i, l, m), 3, 4, 5	<b>Oct 12</b>
<b>M</b>	<b>Oct 10</b>	Ch 16. Infrared spectroscopy (7I, except 16B-2, 16B-3)	Ch 16: 7, 8, 9, 10, Example 16-1	<b>Oct 17</b>
<b>W</b>	<b>Oct 12</b>	Ch 17A-B. Application of IR	none	
<b>M</b>	<b>Oct 17</b>	Ch 18. Raman Spectroscopy		
<b>W</b>	<b>Oct 19</b>		Ch 18: 2, 3, 7	<b>Oct 26</b>
<b>M</b>	<b>Oct 24</b>	Ch 19A-E. Nuclear Magnetic Resonance		
<b>W</b>	<b>Oct 26</b>		Ch 19: 2, 3, 4, 10	<b>Oct 31</b>
<b>M</b>	<b>Oct 31</b>	Exam review		
<b>W</b>	<b>Nov 2</b>	<b>Exam 2</b>		
<b>M</b>	<b>Nov 7</b>	Ch 11A-C, Ch 20A-C: Mass Spectrometry	Ch 11: 3, 4, Ch 20: 4(a), 11	<b>Nov 14</b>
<b>W</b>	<b>Nov 9</b>	Ch 26. Intro to Chromatograph	Ch. 26: 2, 7, 14, 15	<b>Nov 16</b>
<b>M</b>	<b>Nov 14</b>	Ch 27A-C. Gas Chromatography		
<b>W</b>	<b>Nov 16</b>	Ch 28A-H. Liquid Chromatography	Ch. 27: 3, 9, Ch 28: 22	<b>Nov 28</b>
<b>Thanksgiving</b>				
<b>M</b>	<b>Nov 28</b>	Ch 30A-C. Capillary Electrophoresis	none	
<b>W</b>	<b>Nov 30</b>	Ch 23A-F, 25A-D: Electrochemistry	none	
<b>M</b>	<b>Dec 5</b>	Exam Review		
<b>W</b>	<b>Dec 7</b>	<b>Exam 3</b>		
<b>W</b>	<b>Dec 14</b>	<b>Final Exam (9:45-11:45am)</b>		

\* Final exam schedule is determined by the Registrar's office.